# CHLORPYRIFOS TECHNICAL BRIEFING

June 8, 2000

# Overview

Lois Rossi, Director
Special Review and Reregistration Division
OPP

## Overview of Day's Activities

- Legal framework and regulatory history
- Provide usage profiles
- Present risk assessments
- Questions and comments



## Goals of Meeting

- Provide an understanding of EPA's risk assessments
- Answer your questions
- Identify risks of concern
- Begin risk mitigation dialog

## Legal Context

FQPA amendments to FIFRA required

- Reassessment of all existing tolerances
- Aggregate assessments
- Safety factor for children
- Cumulative assessments



## EPA Implementation of FQPA

- Formation of Tolerance Reassessment Advisory Committee (TRAC)
- Development of science policies
- Development of pilot process for public participation
- Focus on OPs



## TRAC Pilot OP Review Process

- Phase 1 (30 days)
  - Registrant "error only" review
- Phase 2 (up to 30 days)
  - EPA considers registrants' comments
- Phase 3 (60 days)
  - Public comment on preliminary risk assessment



## TRAC Pilot OP Review Process (cont.d)

- Phase 4 (90 days)
  - EPA revises risk assessments, holds public meetings/technical briefings
- **Phase 5 (60 days)**
  - **EPA solicits risk management ideas**
- Phase 6 (up to 60 days)
  - EPA develops final risk management strategies

## Agreement with Registrants

- Agency had discussions with Dow, and other technical and MUP registrants
- Achieved agreement that addresses risk of concern
- Public participation will allow comments
  - Focus on remaining issues – worker and ecological risk mitigation
  - 6f process for cancelled uses



## Summary of Agreement

- For Agricultural Uses
  - Restrict apples to pre-bloom
  - Remove use on tomatoes



## Summary of Agreement

- For Residential Non-Termiticide Uses
  - All uses removed except golf courses, containerized baits, and two public health uses (mosquitocide and fire ant)
- For Other Non-Termiticide Uses
  - All uses removed except limited use in industrial settings



## Summary of Agreement

- For Termiticide Uses
  - Whole house post-construction removed
  - Limited spot and local post-construction phased out (by 2002)
  - Pre-construction phased out (by 2005)

## Regulatory History and Comments

Mark Hartman, Chemical Review Manager
Special Review and Reregistration Division
OPP

## Regulatory History

- First registered in 1965 by Dow Chemical Company
- Registrants are:
  - DowAgroSciences
  - Mahketshim-Agan
  - Gharda
  - Cheminova
  - Luxembourg-Pamol
  - Platte Chemical
- Registration Standards issued in 1984 and 1989



## Phase 3 Public Comment

- Over 4,000 comments received
- Comments received from:
  - Registrants
  - Environmental/Consumer Organizations
  - Commodity Associations
  - Extension Personnel
  - Government Officials
  - Growers
  - Retailers
  - Crop Consultants
  - Pest Control Operators
  - Lawn Care Professionals
  - Golf course superintendents
  - Private Citizens



## Environmental and Consumer Comments

- Common mechanisms of toxicity
- FQPA 10X Safety Factor
- Highly exposed populations
- Data requirements/assumptions
- Transitioning to safer alternatives
- Incidents/Illnesses
- TCP

## Registrant Comments

- Toxicological Endpoint Selection
- FQPA Safety Factor Determination
- Ecological Assessment



## User Community Comments

- Importance to IPM programs
- Effectiveness and economics
- Lack of equivalent alternatives
- Use of processing factors in dietary analysis



## Phase 4
## Revise Risk Assessments

- Changes to the risk assessment
  - Refined dietary assessment
  - Revised worker assessment
  - Revised residential assessment
  - Revised ecological assessment



## Phase 5

- Technical briefing
- Revised risk assessment (incorporating all studies) available in public docket and on the internet
- Begin 60-day public participation period
- Public input on risk management
- Opportunities for growers and other to meet with EPA

# CHLORPYRIFOS Use Profile

Tim Kiely, Economist
Biological and Economic Analysis Division
OPP

## Use Profile

- Organophosphate Insecticide/Acaricide/Nematicide
- Currently Not a Restricted Use
- 12 Formulation of End Use Products
  - 827 Active Labels



## Use Profile

| End Use Products | % AI |
|---|---|
| Emulsifiable Concentrate | 0.25 – 62.5 |
| Soluble Concentrate/Liquid | 0.5 – 62.5 |
| Wettable Powder | 25 - 50 |
| Water Dispersible Granules | 50 |
| Granular | 0.14 – 15.3 |
| Flowable Concentrate | 30 |
| Microencapsulated | 0.2 – 20 |
| Liquid-Ready to Use | 0.05 – 17.4 |
| Pressurized Liquid | 0.1 – 8 |
| Bait/Solid | 0.3 – 1 |
| Dust | 0.5 – 7 |
| Impregnated Material/Collar/Tag | 3 – 20 |



## Use Profile

- 358 Use Sites
  - Agricultural Uses
    - Field Crops
      - Corn, sorghum, tobacco, wheat, alfalfa, peanuts, soybeans, sunflower, cotton, sugar beets, mint, lentils, rice, sugarcane
    - Vegetables
      - Onions, peppers, kale, broccoli, brussel sprouts, cabbage, cauliflower, collards, cucurbits, asparagus, tomatoes, beans, peas, chinese cabbage, kohlrabi, broccoli raab, sweet corn, carrots, radish, rutabaga, turnip, sweet potatoes
    - Fruit
      - Citrus, apples, figs, prunes, pears, nectarines, cherries, peaches, plums, grapes, strawberries, bananas, craneberries
    - Nut Trees
      - Almonds, pecans, walnuts, chestnuts, filberts, macadamias

## Use Profile

- Residential Uses
  - Lawn and Turf
  - Ornamentals
  - Structural (Termiticide)
  - Pets
- Public Health (i.e., Mosquito Control) and Quarantine (i.e., Fire Ant Control) Uses
- Other
  - Livestock
  - Food Handling Establishments
  - Forestry



## Use Profile

- Application Method (list only representative)
  - Soil Treatment (banded, rodded, in-furrow, mound, etc.)
  - Spray (low volume, high volume, surface, foliar, etc.)
  - Seed Treatment
  - Tree Bark Treatment
  - Crack and Crevice Treatment
  - Perimeter Treatment



## Use Profile

- Application Equipment (list is only representative)
  - Airblast Sprayer
  - Groundboom Sprayer
  - Aerial Sprayer
  - Tractor-drawn Granular Spreader
  - Hand-held Sprayers (LP Handwand, HP Handwand, Hose-end Sprayer, etc.)
  - Aerosol Can
  - Push-type Spreaders

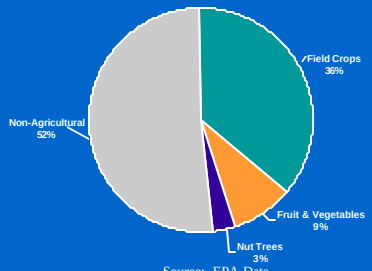


## Use Profile

- Average Agricultural Use Rates
  - Most acreage treated at a rate of 2 lbs/ai or less per application
  - Most acreage treated at 4 lbs/ai or less per year
- Typical Usage
  - Estimated 21 million lbs ai applied annually to all sites
    - Largest agricultural market is corn at 26% of total lbs applied
    - No other crop accounts for >3% of total lbs applied
    - Largest non-agricultural markets are PCO Termite Control (24%) and Professional Turf (12%)
  - Agricultural sites – 10 million lbs ai applied
  - Non-Agricultural sites – 11 million lbs ai applied

## Use Profile

Chlorpyrifos Usage
As a % of Total lbs Applied
In Agricultural and Non-Agricultural Markets

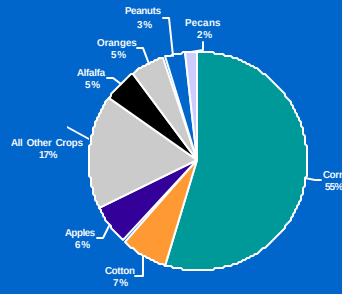



Source: EPA Data
Estimated 21 million lbs applied



## Use Profile

Chlorpyrifos Usage
As a % of Total lbs Applied
In US Agricultural Markets

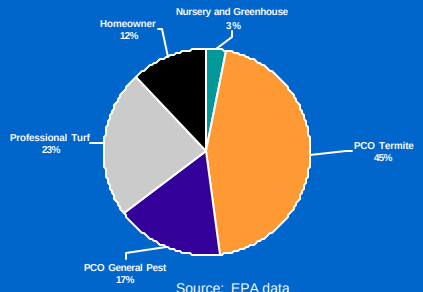



Source: EPA Data
Estimated 10 million lbs Applied



## Use Profile

Chlorpyrifos Usage
As a % of Total lbs Applied
In US Non-Agricultural Markets




Source: EPA data
Estimated 11 million lbs Applied

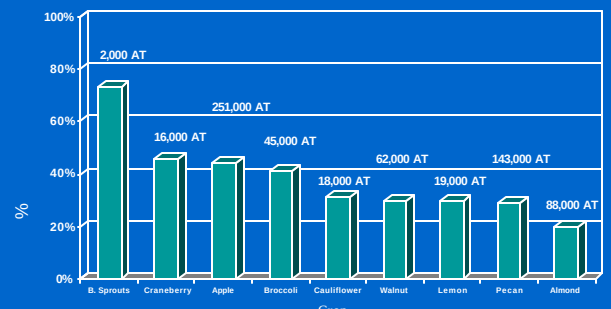


## Use Profile

- Major Uses by Estimated % Crop Treated
  - Only 9 crops with >20% Crop Treated (see figure)
  - % Crop Treated for other Select Crops
    - Corn: 7% Crop Treated (4.7 million acres treated)
    - Oranges: 14% Crop Treated (118,000 acres treated)
    - Grapes: 2% Crop Treated (17,000 acres treated)
    - Tomatoes: 2% Crop Treated (11,000 acres treated)

## Use Profile

Major Crop Use by % Crop Treated




Source: EPA Data
AT=Estimated Acres Treated



## Use Profile

- Major Uses by Estimated % Crop Treated
  - Only 9 crops with >20% Crop Treated (see figure)
  - % Crop Treated for other Select Crops
    - Corn: 7% Crop Treated (4.7 million acres treated)
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## Use Profile

- Sources of Use Data
  - USDA/NASS
  - National Center for Food and Agricultural Policy
  - California Department of Pesticide Regulation
  - Commodity/User Groups
  - US EPA Proprietary Databases
  - Website
    - http://www.epa.gov/oppbead1/use-related.pdf



## CHLORPYRIFOS
## Health Effects Risk Assessment

Jess Rowland, Chief, Reregistration Branch 3
Debbie Smegal, Toxicologist/Risk Assessor
Steve Knizner, Chemist
Tim Leighton, Environmental Health Scientist

## Risk Assessment Components

- Dietary
  - Food
  - Drinking Water
- Occupational (Agricultural Workers)
- Residential
  - Handlers
  - Post Application
- Aggregate
  - Food
  - Drinking Water
  - Residential



## Hazard Identification Process

- Weight of evidence approach
- Review/evaluation of all toxicology studies
- Select studies appropriate for route and duration of exposure scenario



## Hazard Identification Process

- Consider all adverse effects seen – species/sex/route/duration
- Select critical endpoint of concern
- Select the dose for the critical effect
- Critical toxic effect (endpoint) selected would be protective of all potential toxic effects



## Effect Levels

- Lowest Observed Adverse Effect Level = LOAEL
  - The lowest dose at which an “adverse” health effect is seen (mg per kg body weight per day)
- No Observed Adverse Effect Level = NOAEL
  - The dose at which no “adverse” health effect is seen. This dose is less than the LOAEL (mg per kg body weight per day)

## Uncertainty and Safety Factors

- 10X — Interspecies Extrapolation
- 10X — Intraspecies Variation
- 1X to 10X — FQPA Safety Factor

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- 100X to 1000X — Total Uncertainty and Safety Factors for Risk Assessment



## CHLORPYRIFOS
## Hazard Identification for Dietary and Non-Dietary Risk Assessments

## Acute Hazard (Toxicity)

- **Studies:** Two acute (single dose) studies
- **Endpoint**
  - Plasma and RBC cholinesterase inhibition
- **NOAEL:** 0.5 mg/kg/day
- **LOAEL:** 1.0-1.5 mg/kg/day

*Endpoint reflects the potential toxicity which could result from one-day exposure to chlorpyrifos*



## Chronic Hazard (Toxicity)

- **Studies:** Weight of Evidence using 5 studies
- **Endpoint**
  - Plasma and RBC cholinesterase inhibition
- **NOAEL:** 0.03 mg/kg/day
- **LOAEL:** 0.22-0.3 mg/kg/day

*Endpoint reflects the potential toxicity which could result from long-term exposure to chlorpyrifos*

## Analysis of Sensitivity/Susceptibility of the Young (FQPA Safety Factor)

**Rationale for Retaining 10X Factor**

- Increased neonatal sensitivity following a low single oral exposure
- Unique susceptibility of the offspring demonstrated in the DNT study
- The adverse effects on brain development may occur in the absence of ChE inhibition
- Lack of an offspring NOAEL for alterations in brain development – DNT

**10X is Applied To – Infants/Children/Females of Child Bearing Age**

- Acute and chronic dietary exposures
- All residential/non-occupational exposures



## Uncertainty Factors

- 10X Interspecies Extrapolation
- 10X Interspecies Variation
- 10X FQPA Safety Factor

Total UF Applied:

- General Population: 100
- Infants and Children: 1000
- Females of Child Bearing Age: 1000



## Expression of Risk

Dietary Exposure

RfD = Reference Dose
PAD = Population Adjusted Dose (less than 100% PAD is not concern)

$$RfD = \frac{NOAEL}{UF}$$

$$PAD = \frac{RfD}{FQPA\ Safety\ Factor}$$

$$\%\ PAD = \frac{Exposure}{PAD} \times 100$$



## Population Adjusted Dose (PAD)

Acute PAD

**General Population**

$$RfD = \frac{0.5\ mg/kg/day}{100\ UF} = 0.005\ mg/kg/day$$

$$aPAD = \frac{RfD}{1\ FQPA\ SF} = \frac{0.005\ mg/kg/day}{1} = \mathbf{0.005\ mg/kg/day}$$

**Children and Females of the Child Bearing Age**

$$RfD = \frac{0.5\ mg/kg/day}{100} = 0.005\ mg/kg/day$$

$$aPAD = \frac{RfD}{10\ FQPA\ SF} = \frac{0.005\ mg/kg/day}{10} = \mathbf{0.0005\ mg/kg/day}$$

## Population Adjusted Dose (PAD)

Chronic PAD

**General Population**

RfD = 0.03 mg/kg/day = 0.0003 mg/kg/day
100 UF

cPAD = RfD / 1 FQPA SF = 0.0003 mg/kg/day / 1 = **0.0003 mg/kg/day**

**Children and Females of the Child Bearing Age**

RfD = 0.03 mg/kg/day = 0.0003 mg/kg/day
100 UF

cPAD = RfD / 10 FQPA SF = 0.0003 mg/kg/day / 10 = **0.00003 mg/kg/day**



## Expression of Occupational/Residential Risk

MOE = NOAEL / Exposure

- MOE: Margin of Exposure
- Target MOE: 100 (occupational)
  1000 (residential)
- The larger the MOE, the lesser the concern



## Occupational/Residential Risk Assessment - Dermal

- Short-term exposure
  - **Study:** 21-day dermal – rat
  - **Endpoint:** Plasma and RBC cholinesterase inhibition
  - **NOAEL:** 5 mg/kg/day
  - **LOAEL:** 10 mg/kg/day
  - **Target MOE:** 100 (occupational)
    1000 (residential)*

* Includes the 10X FQPA Safety Factor



## Occupational/Residential Risk Assessment - Dermal

- Intermediate and long-term exposure
  - **Study:** Weight of Evidence using 5 studies
  - **Endpoint:** Plasma and RBC cholinesterase inhibition
  - **NOAEL:** 0.03 mg/kg/day
  - **LOAEL:** 0.22 mg/kg/day
  - **Dermal absorption:** 3% (oral equivalent)
  - **Target MOE:** 100 (occupational)
    1000 (residential)

## Occupational/Residential Risk Assessment - Inhalation

- Short and intermediate-term
  - **Study:** Two 90-day inhalation studies
  - **NOAEL:** 0.1 mg/kg/day – highest dose tested
    - No toxic effects observed at highest dose tested
  - **Target MOE:** 100 (occupational)
    1000 (residential)



## Occupational/Residential Risk Assessment - Inhalation

- Long-term
  - **Study:** Weight of Evidence Using 5 studies
  - **Endpoint:** Plasma and RBC cholinesterase inhibition
  - **NOAEL:** 0.03 mg/kg/day
  - **LOAEL:** 0.22 mg/kg/day
  - **Target MOE:** 100 (occupational)
    1000 (residential)
  - **Inhalation Absorption:** 100%



## CHLORPYRIFOS Dietary Risk Assessments

David Soderberg
Steve Knizner
Health Effects Division
OPP

## Dietary Risk Assessments

**Acute**

- Reflects one-day dietary exposures to pesticide residue

**Chronic**

- Reflects lifetime (long-term) exposures to pesticide residues

## Dietary Risk Assessments

Risk = Hazard x Exposure

Dietary Exposure = Consumption x Residue



## Exposure: Consumption

USDA's Continuing Survey of Food Intake by individuals (CSFII) 1989-92 Data

- One-year surveys designed to measure what Americans eat and drink
- Represents the general population and subpopulations including infants and children



## Exposure: Residue

| Tier | Residues Data Used |
|---|---|
| 1 | Tolerance Level Residues |
| 2 | Field Trial Residues |
| 3 | Monitoring Data<br>USDA PDP Data<br>FDA Data |
| 4 | Market Basket Data |



## Exposure: Residue Data

- Field trial data
  - Data used in establishing EPA tolerance levels
    - Used for ~5% of commodities
- Monitoring Data
  - USDA's Pesticide Data Program (PDP) data
    - Prepared as in the home (e.g., washing and peeling)
    - Statistically designed for dietary risk assessment
    - Used for ~50% of commodities

## Exposure: Residue Data

- Monitoring data (cont.d)
  - FDA Surveillance Monitoring Data
    - Designed for tolerance enforcement
    - Large number of samples and types of food
    - Used for ~40% of commodities
  - Market Basket Data
    - DAS National Food Survey
      - 1993-1994
      - 9 Commodities
      - Used for ~10% of commodities



## Exposure: Residue Data

- Monitoring data (cont.d)
  - Processing Data
  - Cooking Factors



## Expression of Dietary Risk

$$RfD = \frac{NOAEL}{UF}$$

$$PAD = \frac{RfD}{FQPA\ Safety\ Factor}$$

$$\%PAD = \frac{Exposure}{PAD} \times 100$$

<100% PAD not concern



## Probabilistic Acute Dietary Analysis Results

Phase 5 Revised Risk Assessment
Risk Estimates Percent of aPAD* (99.9th Percentile Exposure)

| Population | Pre-Mitigation | Post-Mitigation |
|---|---|---|
| U.S. Population | 16 | 5 |
| Infants | 130 | 52 |
| Children 1-6 | 355 | 82 |
| Children 7-12 | 258 | 64 |
| Females | 127 | 40 |

*aPAD = 0.0005 mg/kg/day for children and females

## Chronic Dietary Analysis Results

Phase 5 Revised Risk Assessment
Risk Estimates as Percent of the cPAD*

| Population | Pre-Mitigation | Post-Mitigation |
|---|---|---|
| U.S. Population | 4 | 3 |
| Infants | 45 | 33 |
| Children 1-6 | 81 | 51 |
| Children 7-12 | 59 | 36 |
| Females | 30 | 20 |

*cPAD = 0.00003 mg/kg/day for children and females



## Major Contributors to Acute Risk

- Fresh Tomatoes
  - Mitigation: Delete Use/Remove Tolerance
- Fresh Grapes
  - Mitigation: Decrease tolerance from 0.5 to 0.01 ppm
- Fresh Apples
  - Mitigation: Decrease tolerance from 1.5 to 0.01 ppm
    - Reflect only pre-bloom application



## Drinking Water Risk Assessment

- Conducted because of use pattern and environmental fate profile
- Available drinking water monitoring limited
- Drinking water assessment is based on monitoring data and modeling
- Examined ground and surface water
- Well contamination evaluated separately



## Drinking Water Risk Assessment

- Groundwater
  - Modeling Data
    - SCI-GROW
    - Crops Modeled
      - Sweet corn, cotton, alfalfa, and citrus
    - Model Estimated Environmental Concentrations (EECs) Range from
      - 0.007 ppb (alfalfa) to 0.1 ppb (sweet corn)
    - Monitoring data confirm chlorpyrifos does not impact groundwater

## Drinking Water Risk Assessment

- Groundwater
  - Conservative EEC range of 0.007 to 0.1 ppb
  - Acute and chronic exposure
  - Based on modeling data with support from monitoring data
  - Concentration <0.1 ppb for >99% U.S. population



## Drinking Water Risk Assessment

- Surface Water
  - NAWQA Monitoring Data
    - More than 3000 samples
    - CPY detected at frequencies of:
      - 16% in ag streams (n=1530)
      - 20% in mixed land use streams (n=245)
      - 26% in urban streams in 1997 (n=604)
      - 65% in urban streams from GA, AL, FL, in 1994 (n=57)
    - Maximum concentration in surface water was 0.4 ppb
    - Majority of detections less than 0.1 ppb
    - Data may not represent most vulnerable watersheds



## Drinking Water Risk Assessment

- Surface Water
  - Range of 0.026 ppb to 0.4 ppb (95$^{th}$% to maximum) used for acute
  - 0.026 ppb (95$^{th}$%) used for chronic
  - Based on monitoring data



## Drinking Water Risk Assessment

Allowable Exposure – Food Exposure = Water Exposure

- Drinking Water Level of Comparison (DWLOC) – surrogate measure of drinking water exposure
- Compare DWLOC to EEC
- No concern if EECs less than DWLOC
- Potential concern if EECs greater than DWLOC

## Drinking Water Risk Assessment Results

- There are no acute concerns for residues in drinking water
  - Acute EECs of 0.007 – 0.4 ppb less than DWLOC of 0.9



## Drinking Water Risk Assessment Results

- There are no chronic concerns for residues in drinking water, except possible well contamination
  - EEC of 0.1 ppb less than DWLOC of 0.14 ppb for ground water
  - EEC of 0.026 ppb (95$^{th}$%) less than DWLOC of 0.14 ppb for surface water



## Drinking Water Risk Assessment Uncertainties

- Drinking water (tap water) data not available
- EECs do not include dilution from source to tap
- Treatment may reduce levels
- EECs highly conservative for majority of U.S. population



## Drinking Water Risk Assessment

- Groundwater Impacts of Termiticide Use
  - Result of well contamination
  - Highly localized
  - Wells within 100 feet of treatment
  - Wells with cracked casing
  - Low frequency further reduced with implementation of PR-96-7
    - 1997 28.2 per 100,000 homes (pre PR-96-7)
    - 1998 8.3 per 100,000 homes (post PR-96-7)

# CHLORPYRIFOS
## Occupational/Residential Exposure and Hazard Assessment

Tim Leighton
Debbie Smegal
Health Effects Division
OPP

## Outline of Presentation

- Agricultural Assessment – Tim Leighton
- Residential Assessment – Debbie Smegal



## Agricultural Assessment

- Handlers
  - *professional pesticide applicators and farmer/growers who mix, load and apply pesticides*
- Postapplication Workers
  - *workers who prune, thin, hoe, prop, scout and harvest crops following pesticide application*



## Residential Assessment

- Handler Exposure
  - Professionals (i.e., lawn care operators)
  - Homeowners/Residents
- Postapplication Exposure
  - Professionals (i.e., golf course maintenance workers)
  - Homeowners/Residents

## Agricultural/Residential Risk Assessment - Dermal

- Short-term exposure
  - **Study:** 21-day dermal – rat
  - **Endpoint:** Plasma and RBC cholinesterase inhibition
  - **NOAEL:** 5 mg/kg/day
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  - **Target MOE:** 100 (occupational)
    1000 (residential)*

* Includes the 10X FQPA Safety Factor



## Agricultural/Residential Risk Assessment - Dermal

- Intermediate and long-term exposure
  - **Study:** Weight of Evidence using 5 studies
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## Agricultural/Residential Risk Assessment - Inhalation

- Short and intermediate-term
  - **Study:** Two 90-day inhalation studies
  - **NOAEL:** 0.1 mg/kg/day – highest dose tested
    - No toxic effects observed at highest dose tested
  - **Target MOE:** 100 (occupational)
    1000 (residential)



## Agricultural/Residential Risk Assessment - Inhalation

- Long-term
  - **Study:** Weight of Evidence Using 5 studies
  - **Endpoint:** Plasma and RBC cholinesterase inhibition
  - **NOAEL:** 0.03 mg/kg/day
  - **LOAEL:** 0.22 mg/kg/day
  - **Target MOE:** 100 (occupational)
    1000 (residential)
  - **Inhalation Absorption:** 100%

## Agricultural Handler Assessment

**Handler Exposure and Risk Calculations**

$$\text{Dose} = \frac{\text{(Unit Exposure) x (Amount Handled)}}{\text{Body Weight}}$$

$$\text{MOE} = \frac{\text{NOAEL (mg/kg/day)}}{\text{Dose (mg/kg/day)}}$$



## Agricultural Handler Assessment

- The handler risk assessment is based on
  - Activity (e.g., mixing/loading)
  - Formulation and application equipment
  - Biological monitoring and passive dosimetry studies (five total)
  - Surrogate data
  - Amount of pesticide handled
  - Level of protection (PPE, Engineering Controls)
  - Toxicity endpoint and uncertainty factors



## Agricultural Handler Assessment Scenarios

| Mixer/Loader | Applicator | Flagger |
|---|---|---|
| Liquids (EC)<br>WP (water soluble packets)<br>Granulars | Aerial<br>Groundboom<br>Airblast<br>Tractor-drawn granular spreader<br>Hand-held equipment | Aerial Applications |



## Agricultural Handler Assessment

- Data Sources
  - Labels
  - Use information
  - Standard values
  - Five chemical-specific studies
  - Pesticide Handlers Exposure Database (PHED)

## Agricultural Handler Assessment

Five Chemical-Specific Studies

- Biological monitoring
- Concurrent passive dosimetry
- Activities
  - Mixing/loading liquids for aerial (n=14)
  - Mixing/loading for groundboom (n=3)
  - Mixing/loading for airblast (n=15)
  - Mixing/loading WP for groundboom (n=6)
  - Groundboom applicator (n=9)
  - Airblast applicator (n=15)
  - Mixer/loader/applicator tractor-drawn granular spreader (n=16)
  - Mixer/loader/applicator backpack (n=2)
  - Mixer/loader/applicator low pressure handwand (n=1)
  - Mixer/loader/applicator high pressure handwand (n=13)



## Biological Monitoring Results

- Various levels of PPE (e.g., coveralls, gloves, respirator)
- MOEs
  - 2 scenarios < 10
  - 7 scenarios between 10-50
  - 3 scenarios between 50-100
  - 2 scenarios > 100



## Agricultural Handler Assessment

Pesticide Handlers Exposure Database (PHED)

- Developed by Task Force
- Monitored exposure data
- Consistency
- Widely accepted



## Agricultural Handler MOE Results

| Scenario | MOE ≤ 10 | MOE 10 – 50 | MOE 50 to 100 | MOE ≥ 100 |
|---|---|---|---|---|
| 56 Total | 2 | 6 | 9 | 39 |

Various levels of PPE or engineering controls

## Summary of MOEs of Concern

- MOEs < 10
  - Aerial granular (inhalation)
  - Hand-held sprayer for pine seedling rate
- MOEs 10 to 50
  - Mixing/loading wettable powders (aerial)
  - Hand-held sprayers for greenhouse/nursery
- MOEs 50 to 100
  - Closed loading liquid formulation
  - Aerial sprays (orchard rate)
  - Airblast (citrus rate)
  - Backpack (bark treatments)



## Handler Risk Assessment Summary

- Some scenarios lack exposure data (e.g., peach root stock dipping, dry bulk fertilizer, seed treatment)
- Biological Monitoring Results
  - Many scenarios exceed EPA's level of concern at the level of PPE monitored
  - Validates the need for engineering controls



## Handler Assessment - Uncertainties

- Extrapolate unit exposures to maximum application rates
- Exposure factors: inhalation rates, physiologically matching body weight to surface area
- Clothing protection factors (conservative estimates)



## Agricultural Postapplication Assessment

- Postapplication risk assessment based on:
  - Dislodgeable Foliar Residue (DFR):
    - Amount of pesticide residue that "comes off" when contacted by a worker.
  - Transfer Coefficient (Tc):
    - Indicator of amount of foliar contact by a worker (different for each crop and activity.)
  - 8 hours worked per day, adult body weight
  - Exposure duration
    - Short-term (up to 1 month): Accounts for workers rotating into freshly treated fields
    - Intermediate-term (1 to 6 months): Accounts for long harvesting seasons
    - Most sensitive assessment used to calculate REI
  - Toxicological Endpoint

## Agricultural Postapplication Assessment

Exposure and Hazard Calculations

$$\text{Dose} = \frac{\text{DFR} \times \text{Transfer Coefficient} \times \text{Hrs Worked} \times \text{Absorption}}{\text{Body Weight (kg)}}$$

$$\text{MOE} = \frac{\text{NOAEL (mg/kg/day)}}{\text{Dose (mg/kg/day)}}$$

Calculated REI = Day After Treatment When MOE ≥ 100



## Agricultural Postapplication Assessment

- Sources of Information:
  - Dislodgeable Foliar Residue Data
    - Chemical and crop-specific studies (9 crops)
    - Extrapolating crop-specific studies
  - Transfer coefficients
    - Standard values
    - Chemical-specific studies (scouting, pruning, citrus harvesting)
  - Exposure Factors
    - Standard values (e.g., body weight, hours worked)



## Agricultural Postapplication Assessment

- Postapplication exposure scenarios
  - Harvesting fruits and nuts from trees
  - Harvesting field crops
  - Scouting, pruning, or other non-harvesting activities



## Agricultural Postapplication Assessment

- Time When Calculated Restricted-Entry Intervals (REIs) Result in MOEs > 100

| Crops | Scouting | Harvesting | PHI |
|---|---|---|---|
| All Crops (except as noted) | 24 hours | 24 hours (48 hours sweet potatoes) | Min. 7 days (peppers) |
| Cauliflower | 3 days | 10 days | EC 30 days<br>WP 21 days |
| Citrus | 2 days | 5 days | 21 to 35 days |
| Nut Trees | 2 days | 2 days | Min. 14 days |
| Fruit Trees | 1 day | 4 days | 28 days |

## Agricultural Postapplication Assessment

Uncertainties

- Lack of exposure data – spray drift, soil incorporated treatments
- Transfer Coefficients
- Extrapolating DFR from crop to crop
- Application timing (early season for some crops) and lengthy PHIs
- Exposure Factors



## Agricultural Incidents

- California 1982-1992; 210 agricultural cases involving chlorpyrifos, 100 cases where it was primarily responsible
  - Mainly handlers – 51 %. Drift incidents (35%, half due to one incident) occur
- Rate of systemic incidents per 1000 applications in California range from 0 to 0.55, consistent with median of 0.41 for 28 insecticide alternatives



# CHLORPYRIFOS
# Residential Exposure Assessment

Debbie Smegal
Health Effects Division

## Residential Exposure Assessment

- Handler Exposure
  - Professionals (e.g., lawn care operators)
  - Homeowners/Residents
- Postapplication Exposure
  - Professionals (e.g., golf course maintenance workers)
  - Homeowners/Residents (e.g., golfer, toddler on treated lawns)

## Residential Exposure Assessment (Professionals and Homeowners)

- Data Sources:
  - Registered labels
  - Use information
  - Chemical-specific studies
  - Pesticide Handlers Exposure Database (PHED)
  - Residential Standard Operating Procedures (SOPs)



## Residential SOPs

- Screening level methodology
- Updated assumptions based on Scientific Advisory Panel (SAP) comments
- Used to assess 7 of 9 homeowner handler scenarios
- Used to assess 5 of 9 postapplication scenarios



## Residential Exposure Assessment

- Nine chemical-specific exposure studies

Used to assess

- 4 out of 10 professional handler scenarios
- 1 out of 9 homeowner handler scenarios
- 4 out of 9 postapplication scenarios



## Residential Exposure Assessment

| Mixer/Loader | Applicator | Postapplication |
|---|---|---|
| Liquids<br>WP (water soluble packets)<br>Granulars | Push type spreader<br>Belly grinder<br>Hand<br>Sprinkler can<br>Hand held sprayer<br>Aerosol can<br>Aerial<br>Groundboom | Liquids<br>Granulars<br>Pet collars<br>Dust |

## Professional/Homeowner Handler Assessment

Scenarios Evaluated:

- Liquid Turf Treatment
- Granular Turf Treatment
  - Push-type spreader
  - Belly grinder
  - Hand
- Indoor Crack, Crevice and Spot Treatment
- Insecticidal Dust Application



## Professional/Homeowner Handler Assessment (cont.d)

- Termiticide Treatment (professional)
- Golf Course Treatment (professional)
- Mosquitocide Application (professional)
- Paintbrush Application (homeowner)



## Professional/Homeowner Handler Assessment

- Evaluated minimum, typical and maximum rates
- Dermal and inhalation exposure
- Short, intermediate and long-term (professional)
- Short-term (homeowner)



## Professional Handler Results

- All MOEs less than 100 except
  - Mosquito abatement professionals
  - Golf course workers

## Homeowner Handler Results

- All scenarios result in MOEs less than 1000 except
  - Limited crack and crevice spot treatment (2 oz of 0.5% material)



## Postapplication Professional Assessment

- Golf course maintenance workers
  - MOEs greater than 100



## Postapplication Residential Assessment

Evaluated nine scenarios:

- Turf Treatment (liquid, granular)
- Yard and Ornamental Sprays
- Golf Course Use
- Indoor Crack, and Crevice
- Post Construction Termiticide Treatment
- Pet Collar Uses
- Mosquitocide Abatement Use
- Perimeter Treatment of Residence



## Postapplication Residential Results

- All MOEs less than 1000 except
  - Mosquito abatement use
  - Golf course use

## Termiticide Postapplication Data

- DAS air monitoring study for 31 homes
- Air concentrations measured in kitchen, bedroom, and basement
- Four types of homes assessed: basement, slab, crawlspace, and plenum
- Applications conducted according to current label at 1%



## Termiticide Postapplication Assumptions

- Inhalation exposure of primary concern
- Calculated incremental time weighted average air concentrations
- Air concentrations normalized to 0.5% ai
  - To assess mitigation
- Evaluated both 90 day and 1 year durations due to uncertainties in toxicity endpoints



## Residential Risk Postapplication

Termiticide Use MOEs for Children 1-6

| Home Type | Range of MOEs 90-Day TWA | Range of MOEs 1-Year TWA |
|---|---|---|
| Basement | 600 - 8700 (median = 3800) | 270 - 2500 (median = 1100) |
| Crawlspace | 950 - 7200 (median = 2100) | 340 - 2100 (median = 530) |
| Slab | 440 - 5800 (median = 1900) | 280 - 2200 (median = 600) |
| Plenum | 460 – 6400 (median = 1900) | 270 – 2700 (median = 760) |



## Uncertainties in Risk Assessment

There are uncertainties associated with

- Endpoint Selection
  - Short exposure time (6 hours day/5 days per week)
  - Route-to-route extrapolation
  - True no observed adverse effect level may be higher
- Chlorpyrifos Air Concentration Data
  - Houses from warm climates may overestimate homes in temperate climates
- Exposure Assumptions
  - Child at home 20 hr/day, 7 days/week for up to 1 year

## Residential Risk Postapplication

Termiticide Use MOEs for Children 1-6

| Home Type | Range of MOEs 90-Day TWA | Range of MOEs 1-Year TWA |
|---|---|---|
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| Slab | 440 - 5800 (median = 1900) | 280 - 2200 (median = 600) |
| Plenum | 460 – 6400 (median = 1900) | 270 – 2700 (median = 760) |



## Termiticide Assessment Conclusions

Adverse effects unlikely:

- Conservative assumptions
- 1000-fold Safety Factor
- Additional 3 to 10-fold cushion between effect level and no effect level in animal studies
- Mitigation measures



## Residential Incidents

- Rate of exposure incidents comparable to other OPs
- Most (92%) reported minor effects (e.g., headaches, nausea)
- Data suggest that exposure to concentrates can lead to more severe effects than ready-to-use formulations or other non-OP pesticides especially in children. Most of these incidents are due to misuse
- Poison Control Center (PCC) data 1993-1996 shows 51% of exposures reported were children <six years old



## Residential Incidents

- DAS initiated a 10-point plan in 1997 to address incidents
- 25% of PCC incidents were related to uses that were cancelled by the 10-point plan
- Recent study of chlorpyrifos applicators (NIOSH) did not find evidence of chronic neurobehavioral effects, except in a subset of poisoned workers
- 98% of exposures are due to products removed under the risk mitigation plan

## Aggregate Risk Assessment

- Includes exposure from various sources
  - Food
  - Drinking water
  - Residential and Recreational Uses
- Both adults and children considered



## Aggregate Risk Assessment

Based on use changes reflecting mitigation measures

- Acute aggregate does not exceed level of concern
  - Food – highly refined
  - Water – unrefined
- Short-term aggregate risk does not exceed level of concern
  - Food – highly refined
  - Water – unrefined
  - Residential – conservative
    - Golfers - mosquitocide



## Aggregate Risk Assessment

Based on changes reflecting mitigation measures

- Chronic aggregate risk does not raise a concern
  - Food – highly refined
  - Water – unrefined
  - Residential – mitigation should reduce exposure



## TCP Assessment Toxicity/Risk of TCP

- TCP less toxic than parent chlorpyrifos
- Risk assessments for chlorpyrifos are protective of possible effects from TCP

## TCP Assessment
## Major Sources of TCP Exposures

SOURCES OF TCP:

- Chlorpyrifos 20,000,000 lbs/ai/yr
- Chlorpyrifos-methyl 90,000 lbs/ai/yr
- Triclorpyr 1,000,000 lbs/ai/yr

- Numerous studies show low levels of TCP in the urine of 77-100% of subjects tested



## Environmental Fate and Effects Assessment

Daniel Rieder
Biologist
Environmental Fate and Effects Division
OPP

## Environmental Fate and Effects Assessments

- Environmental Fate Assessment
  - Lab and Field Studies (Characterize Persistence, Mobility, & Bioaccumulation)
- Water Resources Assessment
  - Modeling and Monitoring (Estimate Potential Exposure)
- Ecological Toxicity
  - Acute and Chronic Tests (Determine Toxicity to Terrestrial and Aquatic Organisms)
  - Terrestrial and Aquatic Field Studies (Determine Toxic Effects in Field)



## Ecological Risk Assessment: (Deterministic)

- Compare exposure estimates to ecological toxicity to determine potential effects
- Calculate risk quotient: $\frac{EEC}{TOX} = RQ$
- RQ > LOC suggests potential risk
- Intentionally conservative (accounts for wide ranges of variability)

## Risk Characterization

- Refines the Tier 1 Deterministic Assessment
  - Begins with the deterministic assessment but goes further
  - Considers other information such as fate, and extent of usage
  - Compares exposure estimates to field study residue data
  - Biomonitoring data used to verify acute effects
  - Compare predicted effects with incidents



## Laboratory Fate Data

- Breakdown by water (hydrolysis)
  - Half-life 73 days (neutral and acidic conditions)
  - Half-life 16 days (alkaline conditions)
- Breakdown in light (photolysis) half-life 30 days
- Aerobic soil half-lives range from 11 to 180 days in 8 soils



## Laboratory Fate Data

- Anaerobic soil half-lives are 39 and 51 days in two soils
- Binds readily to soil (Kd values: 50 to 260)
- Bioaccumulates in aquatic organisms:
  - Residues in tissues decline rapidly in clean water
- Primary degradate: TCP 3,5, 6- trichloro-2-pyridinol



## TCP Laboratory Fate Data

- Highly soluble (500 mg/L) and mobile (Koc of 136)
- Breaks down in light (half-life 1 day)
- Breaks down rapidly via soil photodegradation (half-life 8 hours
- Does not breakdown in water (hydrolysis)
- Does not metabolize under aerobic or anaerobic conditions

## Field Dissipation

- Terrestrial field half-lives under 60 days
- No leaching observed in the field
- Degradate TCP very mobile in soil



## Toxicity to Terrestrial Organisms

- Birds
  - Moderately to very highly toxic
  - Reproductive effects
    - Reduction in number of eggs laid
    - Reduction in adult body weight
- Mammals
  - Slightly to highly toxic
  - Reproductive effects
    - Reduction in pup weight
    - Increase in pup mortality
- Bees
  - Highly toxic
    - Short-term residual toxicity at 1 lb/A



## Toxicity to Aquatic Organisms

- Fish: Freshwater and Estuarine
  - Moderately to very highly toxic
  - Reproductive effects
    - Reduction in number of young
- Invertebrates: Freshwater and Estuarine
  - Very highly toxic to crustaceans and oyster growth (shell deposition)
  - Moderately to oyster larvae
  - Reproductive effects
    - Reduction in number of young



## TCP (Degradate) Toxicity

- Acute toxicity
  - Birds
    - Practically non-toxic
  - Mammals
    - Slightly to moderately toxic
    - No reproduction test
  - Fish
    - Slightly to moderately toxic
  - Invertebrates
    - Slightly to moderately toxic
- Chronic toxicity
  - No data

## Terrestrial Risk Overview

- The Agency concludes potentially high risk of acute and chronic effects
  - Mammals
  - Birds
- Based on screening level assessment and results of field testing



## Terrestrial Risk (Field Studies)

- Three terrestrial field studies
  - Field corn in Iowa (granular and spray)
  - Orange groves in California (spray blast)
  - Golf courses in central Florida (granular and spray)



## Terrestrial Risk (Field Studies)

- Adverse effects in these field studies
  - Wildlife effects on treated sites (chlorpyrifos detected in tissue)
    - small mammals
    - birds
    - an aquatic turtle
    - snakes (secondary toxicity assumed )
    - adult toads
    - adults frogs
    - tadpoles



## Terrestrial Risk (Field Studies)

Measured Concentrations in Iowa Corn Field 4 EC Spray Study Confirm EECs

| Application | Use rate Lbs ai/A | Measured Crop Foliage Residues (ppm) | Nomograph Based Max. EECs Crop foliage (ppm) |
|---|---|---|---|
| | | | |
| 1st | 3.0 | N/A (preplant) | No Foliage |
| 2nd | 1.5 | 136 to 544 | 203 |
| 3rd | 1.5 | 90 to 417 | Not Calculated |
| 4th | 1.5 | 23 to 256 | 266 |

Lowest Avian LC50 136 ppm and Mammalian herbivores LC50s 102-647 ppm

## Terrestrial Risk (Incidents)

- Terrestrial incidents have been reported
- Wide variety of species affected
  - Birds
  - Mammals
  - Reptiles
  - Uses related to incidents
    - Most incidents – termiticide uses
    - Agricultural crops
    - Turf uses
  - Reported incidents are highest in areas of high human activity



## Aquatic Risk (Summary)

- Aquatic risk assessed using refined models when possible
- Field monitoring and field bioassay data considered
- Based on modeled EECs
  - Acute risk potential is high for
    - Aquatic invertebrates
    - Fish
  - Chronic risk potential
    - High for aquatic invertebrates
    - High for fish in some scenarios
- Risk potential supported by field studies and biomonitoring data
  - Measured residues exceed acute toxicity for aquatic invertebrates and fish
  - Biomonitoring indicates adverse effects from chlorpyrifos
- Risk potential supported by incident reports



## Aquatic Risk (Field Studies)

Agency compared measured aquatic concentration with toxicity

- Field studies with pond measurements
  - Iowa corn, spray and granular
  - California citrus, spray blast
  - Florida golf course, granular and spray



## Aquatic Risk (Field Studies)

Measured Water Concentrations in Iowa Corn Field Studies
Spray Formulation

| 4 EC Application | Use Rate Lbs ai/A | Measured Water Concentration (ppb) | Modeled Water Concentration (ppb) |
|---|---|---|---|
| 1st | 3.0 | < 1 to 6.32 | 11 |
| 2nd | 1.5 | < 1 to 115 | 7.7 |
| 3rd | 1.5 | No data | Not Calculated |
| 4th | 1.5 | < 1 to 2.20 | 24 |

- Level of detection = 1 ppb
- Lowest Fish LC50 1.8 ppb and Aquatic Invertebrate EC50 0.1 ppb
- No reported fish kills

# Aquatic Risk (Field Studies)

Measured Water Concentrations in Iowa Corn Field Studies
Granular Formulation

| 15 G Application | Use Rate Lbs ai/A | Water Concentration (ppb) | Estimated Water Concentration (ppb) |
|---|---|---|---|
| 1st | 3.0 | < 1 | 8.6 |
| 2nd | 1.0 | No data | 3.2 |
| 3rd | 1.0 | < 1 to 1.81 | 6.4 |

- Level of detection = 1 ppb
- Lowest Fish LC50 1.8 ppb and Aquatic Invertebrate EC50 0.1 ppb
- No reported fish kills
- Granular applications resulted in lower water concentrations



# Aquatic Risk (Field Studies)

Measured Water Concentrations in Ponds: California Citrus Field Studies
Airblast

| Application | Use Rate Lbs ai/A | Water Concentration (ppb) | Estimated Water Concentration (ppb) |
|---|---|---|---|
| 1st | 1.5 | < 1 | 7.64 |
| 2nd | 6.0 | < 1 to 486 | 27.6 |
| 1st | 3.5 | < 1 to 1.04 | 18.02 |
| 2nd | 4.0 | < 1 to 2.27 | 29.7 |

- Level of detection = 1 ppb
- Lowest Fish LC50 1.8 ppb and Aquatic Invertebrate EC50 0.1 ppb
- Dead fish were found in ponds adjacent to groves on several occasions



# Aquatic Risk (Field Studies)

Measured Water Concentrations in Florida Golf Course Field Studies

| 4 EC Application | Use Rate Lbs ai/A | Water Concentration (ppb) | Estimated Water Concentration (ppb) |
|---|---|---|---|
| 1st | 4.0 | < 1 | 14.75 |
| 2nd | 4.0 | < 1 | 29.03 |
| | | | |
| 15 G | | | |
| 1st | 4.0 | < 1 | 13.28 |
| 2nd | 4.0 | < 1 to 2.55 | 25.31 |

- Level of detection = 1 ppb
- Lowest Fish LC50 1.8 ppb and Aquatic Invertebrate EC50 0.1 ppb
- On several occasions dead fish found in water hazards some in study area
- Other fish kills occurred outside of the study area



# Aquatic Risk (Field Studies)

Conclusion and evaluation of measured residues in field studies

- Highly variable, often less than modeled value, occasionally higher
- Sometimes measured residues exceed critical toxicity thresholds

## Aquatic Risk (Incidents)

- Aquatic incidents reported
  - Wide variety of species affected
    - Fish (usually large numbers killed)
    - Invertebrates
    - amphibians
  - Uses related to incident
    - Termiticide uses – most incidents
    - Agricultural crops
    - Turf uses
  - Reported incidents highest in high human activity areas



## Aquatic Risk (Termiticide Use)

- Aquatic risks not modeled
- Highest number of reported incidents of any use
- Surface water incidents reported by Dow
  - 1997 – 7.2 per 100,000 structures
  - 1998 – 4.3 per 100,000 structures



## Aquatic Risk
## Sources of Exposure Identified In Biomonitoring Data

- Biomonitoring studies have identified a wide range of sources of surface water exposure
  - Termiticide uses
  - Agricultural runoff
  - Homeowner uses on lawns, gardens, ornamentals, etc.
  - Commercial nurseries (trees and ornamentals)
  - Cleaning of equipment



## Aquatic Risk (Biomonitoring)

- Biomonitoring studies show lethal effects on *Ceriodaphnia*
  - In rainfall in the Sacramento Area
  - In storm sewer discharges in California urban areas
  - In POTW effluents from home uses, cleaning equipment, etc.
  - In streams and rivers

## Aquatic Risk (Biomonitoring)

Examples of biomonitoring data

- Biomonitoring studies show lethal effects on *Ceriodaphnia*
  - Along 43 miles of the San Joaquin River
    - 50% of samples showed lethal effects
- Biomonitoring studies show lethal effects on *Ceriodaphnia*
  - In the upper Newport Bay drainage area, San Diego
    - Homeowner uses
    - Nurseries
- Biomonitoring studies show lethal effects on mysid shrimp
  - In the lower reaches of the Newport drainage area



## Risk Characterization

- Chlorpyrifos uses
  - Pose risks to a broad spectrum of fish and wildlife species
  - Agricultural uses
    - Potentially high risk quotients for fish and wildlife
    - Field studies showed:
      - Exposures exceeding terrestrial and aquatic toxicity
      - Effects seen on all vertebrate classes
      - Incidents of mortality to terrestrial and aquatic species reported



## Risk Characterization (cont.d)

- Termiticide use
  - Associated with reported fish kills in EPA Incident Data System
    - Of all uses, had highest number of terrestrial incidents
- Biomonitoring data indicate widespread aquatic toxicity
  - In agriculture and urban areas



## Comments on Risk Assessments

- Dow has submitted probabilistic assessments
- General Agency response:
  - Many factors to consider that affect exposure and effects distributions
  - Currently reviewing to determine applicability

# Risk Summary and Next Steps

Lois Rossi, Director
Special Review and Reregistration Division
OPP

# Dietary Risk Mitigation

- Mitigation
  - Restrict apple use to pre-bloom
  - Reduce apple tolerance to 0.01 ppm
  - Eliminate tomato use/remove tolerance
  - Reduce grape tolerance to 0.01 ppm



# Mitigated Risks - Dietary

Effect of Mitigation

Risk Estimate as % PAD

| Population Subgroup | % aPAD | % cPAD |
|---|---|---|
| U.S. Population | 5 | 3 |
| Infants | 52 | 33 |
| Children (1-6 years old) | 82 | 51 |
| Children (7-12 years old) | 64 | 36 |
| Females | 40 | 20 |

- Aggregate dietary risk (food and water) not of concern



# Non-Termiticide Risk Mitigation

- For Residential Non-Termiticide Uses
  - All uses removed except golf courses, containerized baits, and two public health uses (mosquitocide and fire ant mounds)
- For Other Non-Termiticide Uses
  - All uses removed except limited use in industrial settings

## Mitigated Risks – Non-Termiticide

- Effects of Mitigation
  - Eliminate exposures and risks of concern for children
  - Exposure to residents from mosquitocide, containerized baits, and fire ant use not of concern
  - Reducing application rate provides adequate MOEs for golfers
  - Removal of most outdoor uses reduces water exposure in urban areas



## Termiticide Risk Mitigation

- For Termiticide Uses
  - Reduce application rate to 0.5%
  - Whole house post-construction removed
  - Limited spot and local post-construction use phased out (by 2002)
  - Pre-construction use phased out (by 2005)



## Mitigated Risks - Termiticide

- With mitigation, these exposures do not raise a concern
- The use with exposure of most concern (whole house barrier treatment) removed
- Exposure/risk from limited local and spot treatment and pre-construction treatment expected to be less



## Mitigated Risks - Aggregate

- Acute and short-term aggregate risks are not of concern
- Chronic aggregate risks with all uncertainties and mitigation considered do not raise a concern

## Summary of Mitigation - Worker

- Agreed to REIs:

| Crops | Harvesting REIs | PHI |
|---|---|---|
| All Crops (except as noted below) | 24 hours (48 hours sweet potatoes) | Min. 7 days (peppers) |
| Cauliflower | 10 days | EC 30 days<br>WP 21 days |
| Citrus | 5 days | 21 to 35 days |
| Nut Trees | 2 days | Min. 14 days |
| Fruit Trees | 4 days | 28 days |



## Mitigated Risks - Worker

- Agreed to REIs address reentry worker risk concerns
- Risks to mixers, loaders, and applicators still require mitigation

| Scenario | MOE ≤ 10 | MOE 10 – 50 | MOE 50 to 100 | MOE ≥ 100 |
|---|---|---|---|---|
| 56 Total | 2 | 6 | 9 | 39 |

Various levels of PPE or engineering controls

- Involve stakeholders



## Summary of Risks - Ecological

- Acute and reproductive risks to many non-target aquatic and terrestrial organisms
- In general, greatest concern is for aquatic organisms



## Summary of Mitigation - Ecological

- Removal of most outdoor uses mitigates water exposure in urban areas as well as many exposures to terrestrial organisms
- Risk mitigation still necessary for other concerns
  - Decrease application rates
  - Decrease number of applications
  - Increase application intervals
  - Involve stakeholders

## Public Comment

- Public participation will allow comments
  - Focus on remaining issues – worker and ecological risk mitigation
  - 6f process for cancelled uses



## Next Steps

- 60-day public comment period
- E-mail comments to:
  - opp-docket@epa.gov
- Mail comments to:

  U.S. EPA
  OP Pesticide Docket (7502C)
  401 M St. SW
  Washington, DC 20460



## Contacts

- Mark Hartman (703)308-0734
- E-mail: hartman.mark@epa.gov